





PATENT  
Attorney Docket No.: NICHIA-00800

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Shuji Nakamura *et al.*

Serial No.: 09/500,288

Filed: February 8, 2000

For: **NITRIDE SEMICONDUCTOR DEVICE**

) Group Art Unit:

)

) Examiner:

)

) **INFORMATION DISCLOSURE STATEMENT**

)

) 260 Sheridan Avenue, Suite 420

) Palo Alto, California 94306

) (650) 833-0160

)

Assistant Commissioner for Patents

Washington, D.C. 20231

Sir:

The citations listed below, copies attached, may be material to the examination of the above-identified application, and are therefore submitted in compliance with the duty of disclosure defined in 37 C.F.R. §§ 1.56 and 1.97. The Examiner is requested to make these citations of official record in this application.

Applicants have become aware of the following printed publications which may be material to the examination of this application:

U.S. Patent No. 3566215

U.S. Patent No. 3593191

U.S. Patent No. 3655439

U.S. Patent No. 3658585

U.S. Patent No. 3704427

U.S. Patent No. 3705567

U.S. Patent No. 3566215

U.S. Patent No. 3593191

U.S. Patent No. 3655439

CERTIFICATE OF MAILING (37 CFR § 1.8(a))

I hereby certify that this paper (along with any referred to as being attached or enclosed) is being deposited with the U.S. Postal Service on the date shown below with sufficient postage as first class mail in an envelope addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231

HAVERSTOCK & OWENS LLP.

Dated: 5/22/00

PATENT  
Attorney Docket No.: NICHIA-00800

U.S. Patent No. 3658585

U.S. Patent No. 3704427

U.S. Patent No. 3705567

U.S. Patent No. 3737737

U.S. Patent No. 3747559

U.S. Patent No. 3793984

U.S. Patent No. 3819974

U.S. Patent No. 3853974

U.S. Patent No. 3941647

U.S. Patent No. 3948693

U.S. Patent No. 3963537

U.S. Patent No. 3965347

U.S. Patent No. 3974561

U.S. Patent No. 4020791

U.S. Patent No. 4062035

U.S. Patent No. 4098223

U.S. Patent No. 4102298

U.S. Patent No. 4108539

U.S. Patent No. 4113381

U.S. Patent No. 4133702

U.S. Patent No. 4140546

U.S. Patent No. 4154625

U.S. Patent No. 4170018

U.S. Patent No. 4261770

U.S. Patent No. 4351695

U.S. Patent No. 4404265

U.S. Patent No. 4410993

U.S. Patent No. 4423349

U.S. Patent No. 4505765

U.S. Patent No. 4521448

PATENT  
Attorney Docket No.: NICHIA-00800

U.S. Patent No. 4531142

U.S. Patent No. 4568206

U.S. Patent No. 4596998

U.S. Patent No. 4599244

U.S. Patent No. 4599245

U.S. Patent No. 4604637

U.S. Patent No. 4615766

U.S. Patent No. 4656636

U.S. Patent No. 4661175

U.S. Patent No. 4670093

U.S. Patent No. 4682337

U.S. Patent No. 4683574

U.S. Patent No. 4722088

U.S. Patent No. 4740259

U.S. Patent No. 4742525

U.S. Patent No. 4744088

U.S. Patent No. 4746195

U.S. Patent No. 4763979

U.S. Patent No. 4768199

U.S. Patent No. 4792200

U.S. Patent No. 4792959

U.S. Patent No. 4818722

U.S. Patent No. 4829188

U.S. Patent No. 4835575

U.S. Patent No. 4841344

U.S. Patent No. 4845723

U.S. Patent No. 4855118

U.S. Patent No. 4859903

U.S. Patent No. 4864369

U.S. Patent No. 4869568

PATENT  
Attorney Docket No.: NICHIA-00800

U.S. Patent No. 4890033

U.S. Patent No. 4904617

U.S. Patent No. 4904618

U.S. Patent No. 4907044

U.S. Patent No. 4907534

U.S. Patent No. 4911102

U.S. Patent No. 4918497

U.S. Patent No. 4929907

U.S. Patent No. 4944837

U.S. Patent No. 4945394

U.S. Patent No. 4946547

U.S. Patent No. 4947218

U.S. Patent No. 4959174

U.S. Patent No. 4960728

U.S. Patent No. 4966862

U.S. Patent No. 4971739

U.S. Patent No. 4977567

U.S. Patent No. 4982314

U.S. Patent No. 4985742

U.S. Patent No. 4987576

U.S. Patent No. 4990466

U.S. Patent No. 4990990

U.S. Patent No. 5005057

U.S. Patent No. 5006908

U.S. Patent No. 5008735

U.S. Patent No. 5008789

U.S. Patent No. 5019746

U.S. Patent No. 5023686

U.S. Patent No. 5027168

U.S. Patent No. 5034956

PATENT

Attorney Docket No.: NICHIA-00800

U.S. Patent No. 5041334

U.S. Patent No. 5042043

U.S. Patent No. 5045896

U.S. Patent No. 5049779

U.S. Patent No. 5061972

U.S. Patent No. 5065207

U.S. Patent No. 5077145

U.S. Patent No. 5093576

U.S. Patent No. 5119540

U.S. Patent No. 5120619

U.S. Patent No. 5122845

U.S. Patent No. 5128955

U.S. Patent No. 5146465

U.S. Patent No. 5155062

U.S. Patent No. 5171370

U.S. Patent No. 5182670

U.S. Patent No. 5184247

U.S. Patent No. 5185207

U.S. Patent No. 5200022

U.S. Patent No. 5202777

U.S. Patent No. 5205905

U.S. Patent No. 5208878

U.S. Patent No. 5210051

U.S. Patent No. 5218216

U.S. Patent No. 5229626

U.S. Patent No. 5233204

U.S. Patent No. 5239188

U.S. Patent No. 5247533

U.S. Patent No. 5250366

U.S. Patent No. 5252499

PATENT  
Attorney Docket No.: NICHIA-00800

U.S. Patent No. 5252839  
U.S. Patent No. 5260960  
U.S. Patent No. 5264713  
U.S. Patent No. 5266503  
U.S. Patent No. 5270554  
U.S. Patent No. 5272108  
U.S. Patent No. 5278433  
U.S. Patent No. 5281830  
U.S. Patent No. 5290393  
U.S. Patent No. 5306662  
U.S. Patent No. 5312560  
U.S. Patent No. 5323022  
U.S. Patent No. 5330791  
U.S. Patent No. 5334277  
U.S. Patent No. 5336080  
U.S. Patent No. 5338944  
U.S. Patent No. 5341390  
U.S. Patent No. 5343316  
U.S. Patent No. 5344791  
U.S. Patent No. 5359345  
U.S. Patent No. 5363390  
U.S. Patent No. 5366834  
U.S. Patent No. 5369289  
U.S. Patent No. 5376303  
U.S. Patent No. 5376580  
U.S. Patent No. 5381103  
U.S. Patent No. 5382822  
U.S. Patent No. 5389571  
U.S. Patent No. 5390210  
U.S. Patent No. 5393993

PATENT

Attorney Docket No.: N1CH1A-00800

U.S. Patent No. 5394005

U.S. Patent No. 5403774

U.S. Patent No. 5404282

U.S. Patent No. 5408120

U.S. Patent No. 5409859

U.S. Patent No. 5416342

U.S. Patent No. 5417886

U.S. Patent No. 5433169

U.S. Patent No. 5433533

U.S. Patent No. 5433888

U.S. Patent No. 5435938

U.S. Patent No. 5438198

U.S. Patent No. 5459107

U.S. Patent No. 5465249

U.S. Patent No. 5467291

U.S. Patent No. 5468678

U.S. Patent No. 5475241

U.S. Patent No. 5497012

U.S. Patent No. 5502316

U.S. Patent No. 5506421

U.S. Patent No. 5511084

U.S. Patent No. 5514627

U.S. Patent No. 5523018

U.S. Patent No. 5523589

U.S. Patent No. 5539217

U.S. Patent No. 5563422

U.S. Patent No. 5578839

U.S. Patent No. 5583879

U.S. Patent No. 5585648

U.S. Patent No. 5587593

PATENT

Attorney Docket No.: NICHIA-00800

U.S. Patent No. 5592501

U.S. Patent No. 5592578

U.S. Patent No. 5596595

U.S. Patent No. 5604135

U.S. Patent No. 5604763

U.S. Patent No. 5612260

U.S. Patent No. 5614736

U.S. Patent No. 5616177

U.S. Patent No. 5620557

U.S. Patent No. 5621749

U.S. Patent No. 5625202

U.S. Patent No. 5627244

U.S. Patent No. 5629531

U.S. Patent No. 5631190

U.S. Patent No. 5635146

U.S. Patent No. 5642375

U.S. Patent No. 5650641

U.S. Patent No. 5652434

U.S. Patent No. 5652438

U.S. Patent No. 5656832

U.S. Patent No. 5659568

U.S. Patent No. 5661074

U.S. Patent No. 5661316

U.S. Patent No. 5661742

U.S. Patent No. 5670798

U.S. Patent No. 5679153

U.S. Patent No. 5684623

U.S. Patent No. 5686737

U.S. Patent No. 5700713

U.S. Patent No. 5707139

PATENT

Attorney Docket No.: NICHIA-00800

U.S. Patent No. 5718760

U.S. Patent No. 5719409

U.S. Patent No. 5724062

U.S. Patent No. 5724373

U.S. Patent No. 5724376

U.S. Patent No. 5727014

U.S. Patent No. 5729029

U.S. Patent No. 5729567

U.S. Patent No. 5733796

U.S. Patent No. 5734182

U.S. Patent No. 5739552

U.S. Patent No. 5739554

U.S. Patent No. 5741431

U.S. Patent No. 5741724

U.S. Patent No. 5742133

U.S. Patent No. 5747832

U.S. Patent No. 5753939

U.S. Patent No. 5758951

U.S. Patent No. 5761229

U.S. Patent No. 5767581

U.S. Patent No. 5771254

U.S. Patent No. 5776837

U.S. Patent No. 5777350

U.S. Patent No. 5777433

U.S. Patent No. 5779924

U.S. Patent No. 5780120

U.S. Patent No. 5785404

U.S. Patent No. 5793054

U.S. Patent No. 5793062

U.S. Patent No. 5805624

PATENT  
Attorney Docket No.: N1CHIA-00800

U.S. Patent No. 5808323  
U.S. Patent No. 5808592  
U.S. Patent No. 5809050  
U.S. Patent No. 5811319  
U.S. Patent No. 5811931  
U.S. Patent No. 5812105  
U.S. Patent No. 5812570  
U.S. Patent No. 5814870  
U.S. Patent No. 5818861  
U.S. Patent No. 5828684  
U.S. Patent No. 5831288  
U.S. Patent No. 5835514  
U.S. Patent No. 5835522  
U.S. Patent No. 5837561  
U.S. Patent No. 5838706  
U.S. Patent No. 5838707  
U.S. Patent No. 5838708  
U.S. Patent No. 5846844  
U.S. Patent No. 5847507  
U.S. Patent No. 5850410  
U.S. Patent No. 5855924  
U.S. Patent No. 5858277  
U.S. Patent No. 5859496  
U.S. Patent No. 5861190  
U.S. Patent No. 5861713  
U.S. Patent No. 5862167  
U.S. Patent No. 5867516  
U.S. Patent No. 5868837  
U.S. Patent No. 5877558  
U.S. Patent No. 5879587

PATENT  
Attorney Docket No.: NICHIA-00800

U.S. Patent No. 5879588  
U.S. Patent No. 5880486  
U.S. Patent No. 5889802  
U.S. Patent No. 5889806  
U.S. Patent No. 5892784  
U.S. Patent No. 5892787  
U.S. Patent No. 5900650  
U.S. Patent No. 5905276  
U.S. Patent No. 5907151  
U.S. Patent No. 5912477  
U.S. Patent No. 5917202  
U.S. Patent No. 5919422  
U.S. Patent No. 5920766  
U.S. Patent No. 5923053  
U.S. Patent No. 5923118  
U.S. Patent No. 5923690  
U.S. Patent No. 5923946  
U.S. Patent No. 5925898  
U.S. Patent No. 5927995  
U.S. Patent No. 5935705  
U.S. Patent No. 5936985  
U.S. Patent No. 5945689  
U.S. Patent No. 5953361  
U.S. Patent No. 5953581  
U.S. Patent No. 5958295  
U.S. Patent No. 5959316  
U.S. Patent No. 5959401  
U.S. Patent No. 5961723  
U.S. Patent No. 5964943  
U.S. Patent No. 5966393

PATENT

Attorney Docket No.: N1CH1A-00800

U.S. Patent No. 5968265

U.S. Patent No. 5969378

U.S. Patent No. 5972781

U.S. Patent No. 5972801

U.S. Patent No. 5973336

U.S. Patent No. 5980631

U.S. Patent No. 5981945

U.S. Patent No. 5981979

U.S. Patent No. 5982970

U.S. Patent No. 5986317

U.S. Patent No. 5991160

U.S. Patent No. 5994722

U.S. Patent No. 5998925

U.S. Patent No. 5999552

CA1325582

EP0356059A2

EP0356059A3

EP0380340A2

EP0380340A3

EP0637069A1

EP0731512A2

EP0731512A3

EP0781619A1

EP0871208A2

EP0871208A3

EP0880181A2

EP0880181A3

EP0905799A2

EP0936682A1

**PATENT**  
Attorney Docket No.: NICHIA-00800

EPOFR2613136

GB2322737A

GB2323210A

JP05152609

JP0766192

JP09193137

JP10233529

JP1064854

JP7176794

WO9702478A1

WO9702610A1

WO9717730A1

WO9727629A1

WO9739485A1

WO9750132A1

WO9805078A1

WO9812757A1

WO9834304A1

WO9837586A1

WO9842879A1

WO9842897A1

WO9847185A1

WO9849731A1

WO9857378A1

WO9910936A2

WO9910936A3

WO9918617A1

"Novel Metalorganic Chemical Vapor Deposition System for GaN Growth," S. Nakamura, American Institute of Physics, pp.2021-2023, 5/6/91.

PATENT

Attorney Docket No.: N1CHIA-00800

"Out of the Blue," Forbes Global Magazine, pp.66-71, 9/6/99.

"Nitride PN Junctions Grown on SiC Substrates," V.A. Dmitriev, Inst. Phys. Conf., pp.1019-1022, 1996.

"AlGaN PN Junctions," V.A. Dmitriev, American Inst. of Physics, pp.115-117, 5/11/95.

"Effects of Ar Ion Laser Irradiation on MOVPE of ZnSe using DMZn and DMSe as Reactants," A. Yoshikawa, Journal of Crystal Growth, pp.653-658, 1991.

"Electric Breakdown in GaN P-N Junctions," V.A. Dmitriev, American Inst. of Physics, pp.229-231, 1/8/96.

"High Quality GaN Grown Directly on SiC by Halide Vapour Phase Epitaxy," Y.V. Melnik, Inst. Phys. Conf., pp.863-866, 1996.

"Luminescence Conversion of Blue Light Emitting Diodes," P. Schlotter, Journal of Applied Physics, pp.12-13, 2/27/97.

"P-Type Conduction in Mg-Doped GaN Treated with Low-Energy Electron Beam Irradiation (LEEBI)," H. Amano, Japanese Journal of Applied Physics, pp.2112-2114, 12/89.

"Photoluminescence of Mg-Doped P-Type GaN and Electroluminescence of GaN P-N Junction Led," I. Akasaki, Journal of Luminescence Vol. 48-49, pp.666-670, 1991.

"Recent Progress in AlGaN/GaN Laser Structures on 6H-SiC," G.E. Bulman, SPIE Vol. 2693, pp.57-63, 1996.

"Recent Progress in GaN/SiC LEDs and Photopumped Lasers," G.E. Bulman, pp.100-101, 19xx.

"Role of Growth Initiation for High-Brightness GaN-Based Light Emitting Diodes," R.S. Kern, 2nd. Intern. Symp. on Blue Laser and Light Emitting Diodes, Chiba, Japan, 9/29-10/2/98.



PATENT  
Attorney Docket No.: NICHIA-00800

"The State of SiC: GaN-Based Blue LEDs," J. Edmond, Inst. Phys. Conf. Ser. No. 142, Chap. 6, pp.991-994, 1996.

"Wide Bandgap Group-III Nitride Optoelectronics,"  
<http://www.phy.duke.edu/research/photon/terahertz/gan/index.html>.

"White LED Production at Osram," G. Bogner, Compound Semiconductor, pp.28-31, 5/99.

This Information Disclosure Statement under 37 C.F.R. §§ 1.56 and 1.97 is not to be construed as a representation that a search has been made, that additional information material to the examination of this application does not exist, or that anyone or more of these citations constitutes prior art.

Respectfully submitted,  
HAVERSTOCK & OWENS LLP

Dated: 5/18/00

By: Thomas B. Haverstock

Thomas B. Haverstock  
Reg. No. 32,571  
Attorney for Applicants